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I Semester B.C.A. Degree Examination, March/April - 2023

COMPUTER APPLICATIONS

Discrete Mathematics

(CBCS Scheme)

Time : 3 Hours

Maximum Marks : 100

Instructions to Candidates:

Answer all Sections.

SECTION - A

I. Answer any TEN of the following.

(10×2=20)

- 1) Define power set with an example.
- 2) If $A = \{2,3,5\}$ $B = \{4,5,6\}$ $C = \{1,2\}$ find $A \times (B-C)$.
- 3) Construct truth table for $\sim p \vee q$.
- 4) Define scalar matrix with an example.
- 5) State Caley-Hamilton theorem.
- 6) If $A = \begin{bmatrix} 2 & 1 \\ 4 & -2 \end{bmatrix}$ $B = \begin{bmatrix} -3 & 2 \\ 1 & 4 \end{bmatrix}$ then find $2A - 3B$.
- 7) Prove that $(\log_b^a) \cdot (\log_c^b) \cdot (\log_a^c) = 1$.
- 8) If ${}^nC_8 = {}^nC_9$ then find ${}^nC_{17}$.
- 9) Define Abelian group.
- 10) If $\vec{a} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ $\vec{b} = \hat{i} + 2\hat{j} + 2\hat{k}$ then find $|\vec{a} - \vec{b}|$.
- 11) Find the distance between the points A (-2,3) and B (-4,5).
- 12) Find the equation of straight line passing through (2,5) and having slope 4.



[P.T.O.]



SECTION - B

II. Answer any SIX of the following.

(6×5=30)

- 13) If $A = \{a, b, c, d\}$, $B = \{c, d, e\}$, $C = \{c, e, f, g\}$ then verify $A \times (B - C) = (A \times B) - (A \times C)$.
- 14) If $f: R \rightarrow R$ defined by $f(x) = \mu x - 3$ then prove that f is invertible, also find inverse of f .

15) If $A = \begin{bmatrix} 1 & 2 \\ -3 & 1 \\ 5 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 & -3 \\ -1 & 4 & 2 \end{bmatrix}$ then prove that $(AB)^{-1} = B^{-1} A^{-1}$.

16) Solve the following system of equations using Cramer's rule

$$3x + y + z = 3$$

$$2x + 2y + 5z = -1$$

$$x - 3y - 4z = 2$$

17) Verify Caley-Hamilton theorem for the Matrix $A = \begin{bmatrix} 3 & -1 \\ 1 & 2 \end{bmatrix}$ also find A^{-1} .

18) Prove that $(P \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a Tautology.

19) Prove that $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$.

20) Write the converse, Inverse and contrapositive of "If two integers are equal then their squares are equal".

SECTION - C

III. Answer any SIX of the following.

(6×5=30)

21) If $a^3 + b^3 = ab(8 - 3a - 3b)$, then show that $\log \left(\frac{a+b}{2} \right) = \frac{1}{3} (\log a + \log b)$.

22) In how many ways can the letters of the word "ASSASSINATION" be arranged so that all S's are not together.

23) A Examination question paper consists of 12 questions divided into part A and Part B consists of 7 questions and 5 questions respectively. A student is required to attempt 8 questions, selecting atleast 3 from each part. In how many ways can a student select the questions.



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- 24) Prove that $G = \{0, 1, 2, 3, 4, 5\}$ is an abelian group under addition modulo 6.
- 25) Show that the set of all fourth roots of unity form a group under multiplication.
- 26) If $\vec{a} = \hat{i} - \hat{j} + 2\hat{k}$ $\vec{b} = 2\hat{i} + 3\hat{j} - \hat{k}$ then find $(\vec{a} + 2\vec{b})(2\vec{a} - \vec{b})$.
- 27) Show that the points A(1,2,3) B(2,3,1) and C(3,1,2) are the vertices of an equilateral triangle.
- 28) If the vectors $4\hat{i} + 11\hat{j} + m\hat{k}$, $7\hat{i} + 2\hat{j} + 6\hat{k}$ and $\hat{i} + 5\hat{j} + 4\hat{k}$ are coplanar, then find 'm'.

SECTION - D

IV. Answer any FOUR of the following.

(4×5=20)

- 29) Prove that the points (4,-4), (8,2), (14,-2) and (10,-8) are the vertices of square.
- 30) The three vertices of a parallelogram taken in order are (8,5), (-7, -5), (-5,5). Find the coordinates of the fourth vertex.
- 31) Find the equation of locus of point which moves such that it is equidistant from the points (1,2) and (2,-3).
- 32) Derive the equation of the line whose X- intercept is 'a' and Y-intercept is 'b'.
- 33) If the line $2x - 5y + 1 = 0$ is perpendicular to $(p+1)x + (2p+3)y + 3 = 0$ then find p.
- 34) Find the equation of line passing through the point of intersection of $2x + 3y - 1 = 0$ and $3x + 4y - 6 = 0$ and parallel to the line $5x - y = 0$.